CHAPTER 8

# Configuring IS-IS

This chapter describes how to configure Integrated Intermediate System-to-Intermediate System (IS-IS).

This chapter includes the following sections:



## Information about IS-IS

IS-IS is an Interior Gateway Protocol (IGP) based on Standardization (ISO)/International Engineering Consortium (IEC) 10589. Cisco NX-OS supports Internet Protocol version 4 (IPv4) and IPv6.IS-IS is a dynamic link-state routing protocol that can detect changes in the network topology and calculate loop-free routes to other nodes in the network. Each router maintains a link-state database that describes the state of the network and sends packets on every configured link to discover neighbors. IS-IS floods the link-state information across the network to each neighbor. The router also sends advertisements and updates on the link-state database through all the existing neighbors.

This section includes the following topics:

# IS-IS Overview

IS-IS sends a *hello packet* out every configured interface to discover IS-IS neighbor routers. The hello packet contains information, such as the authentication, area, and supported protocols, which the receiving interface uses to determine compatibility with the originating interface. Compatible interfaces form adjacencies, which update routing information in the link-state database through link-state update messages (LSPs). By default, the router sends a periodic LSP refresh every 10 minutes and the LSPs remain in the link-state database for 20 minutes (the LSP lifetime). If the router does not receive an LSP refresh before the end of the LSP lifetime, the router deletes the LSP from the database.

The LSP interval must be less than the LSP lifetime or the LSPs time out before they are refreshed.

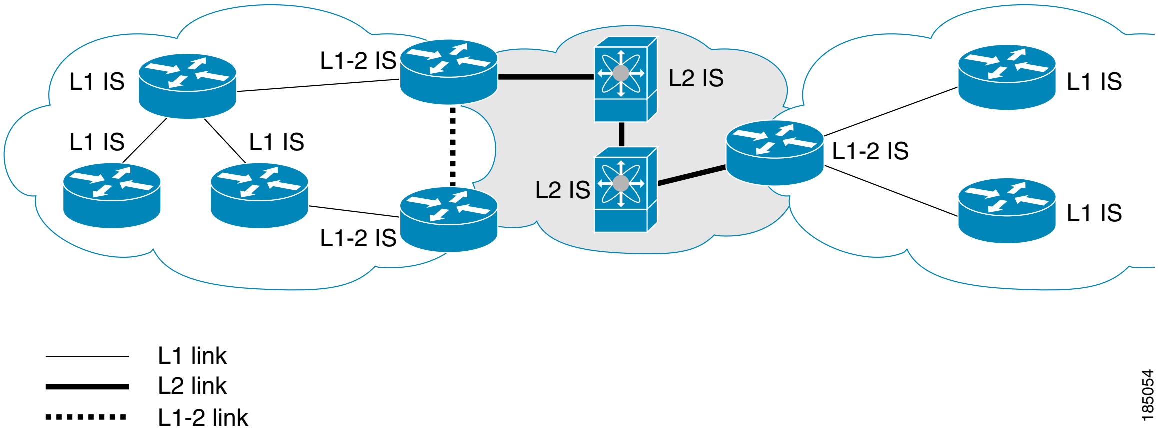
## IS-IS Areas

You can design IS-IS networks as a single area that includes all routers in the network or as multiple areas that connect into a backbone or Level 2 area. Routers in a nonbackbone area are Level 1 routers which establish adjacencies within a local area (intra-area routing). Level 2 area routers establish adjacencies to other Level 2 routers and perform routing between Level 1 areas (inter-area routing). A router can have both Level 1 and Level 2 areas configured. These Level 1/Level 2 routers act as area border routers which route information from the local area to the Level 2 backbone area (see Figure 8-1).

Within a Level 1 area, routers know how to reach all other routers in that area. Between areas, routers know how to reach the area border router to get to the Level 2 area. The Level 2 routers know how to reach other area border routers and other Level 2 routers. Level 1/Level 2 routers straddle the boundary between two areas, routing traffic to and from the Level 2 backbone area.

Each IS-IS instance in Cisco NX-OS supports either a single Level 1 or Level 2 area, or one of each. By default, all IS-IS instances automatically support Level 1 and Level 2 routing.

*Figure 8-1 IS-IS Network Divided into Areas*




An autonomous system boundary router (ASBR) advertises external destinations throughout the IS-IS autonomous system. External routes are the routes redistributed into IS-IS from any other protocol.

## NET and System ID

Each IS-IS instance has an associated network entity title (NET). The NET is comprised of the IS-IS system ID, which uniquely identifies this IS-IS instance in the area and the area ID. For example, if the NET is 47.0004.004d.0001.0001.0c11.1111.00, then the system ID is 0000.0c11.1111.00 and the area is ID 47.0004.004d.0001.

## Designated Intermediate System

IS-IS uses a designated intermediate system (DIS) in broadcast networks to prevent each router from forming unnecessary links with every other router on the broadcast network. IS-IS routers send LSPs to the DIS, which manages all the link-state information for the broadcast network. You can configure the IS-IS priority which IS-IS uses to select the DIS in an area.

**Note** No DIS is required on a point-to-point network.

# IS-IS Authentication

You can configure authentication to control adjacencies and the exchange of LSPs. Routers that want to become neighbors must exchange the same password for their configured level of authentication. IS-IS blocks a router that does not have the correct password. You can configure IS-IS authentication globally or for an individual interface for Level 1, Level 2, or both Level 1/Level 2 routing.

IS-IS supports the following authentication methods:

- Clear text—All packets exchanged carry a cleartext 128-bit password.
- MD5 digest—All packets exchanged carry a message digest that is based on a 128-bit key.

To provide protection against passive attacks, IS-IS never sends the MD5 secret key as cleartext through the network In addition, IS-IS includes a sequence number in each packet to protect against replay attacks.

You can use also keychains for hello and LSP authentication. See *Cisco Nexus 7000 Series NX-OS Security Configuration Guide, Release 4.0* for information on keychain management.

## Mesh Groups

A *mesh group* is a set of interfaces in which all routers reachable over the interfaces have at least one link to every other router. Many links can fail without isolating one or more routers from the network.

In normal flooding, an interface receives a new LSP and floods the LSP out over all other interfaces on the router. With mesh groups, when an interface that is part of a mesh group receives a new LSP, the interface does not flood the new LSP over the other interfaces that are part of that mesh group.

**Note** You may want to limit LSPs in certain mesh network topologies to improve network scalability. Limiting LSP floods may also reduce the reliability of the network (in case of failures). For this reason, we recommend that you use mesh groups only if specifically required, and then only after careful network design.

You can also configure mesh groups in block mode for parallel links between routers. In this mode, all LSPs are blocked on that interface in a mesh group after the routers initially exchange their link-state information.

## Overload Bit

IS-IS uses the overload bit to tell other routers not to use the local router to forward traffic but to continue routing traffic destined for that local router.

You may want to use the overload bit in these situations:

- The router is in a critical condition.
- Graceful introduction and removal of the router to/from the network.
- Other (administrative or traffic engineering) reasons. For example, to wait for BGP convergence.

## Route Summarization

You can configure a summary aggregate address. Route summarization simplifies route tables by replacing a number of more-specific addresses with an address that represents all the specific addresses. For example, you can replace 10.1.1.0/24, 10.1.2.0/24, and 10.1.3.0/24 with one summary address, 10.1.0.0/16.

If more specific routes are in the routing table, IS-IS advertises the summary address with a metric equal to the minimum metric of the more specific routes.

**Note** Cisco NX-OS does not support automatic route summarization.

## Route Redistribution

You can use IS-IS to redistribute static routes, routes learned by other IS-IS autonomous systems, or routes from other protocols. You configure redistribution by using a route policy to control which routes are passed into IS-IS. A route policy allows you to filter routes based on attributes such as the destination, origination protocol, route type, route tag, and so on. For more information, see Chapter 15, "Configuring Route Policy Manager."

Whenever you redistribute routes into an IS-IS routing domain, Cisco NX-OS does not, by default, redistribute the default route into the IS-IS routing domain. You can generate a *default route* into IS-IS, which can be controlled by a route policy.

You also configure the default metric that is used for all imported routes into IS-IS.

## Load Balancing

You can use load balancing to allow a router to distribute traffic over all the router network ports that are the same distance from the destination address. Load balancing increases the utilization of network segments and increases effective network bandwidth.

Cisco NX-OS supports the Equal Cost Multiple Paths (ECMP) feature with up to 16 equal-cost paths in the IS-IS route table and the unicast RIB. You can configure IS-IS to load balance traffic across some or all of those paths.

## Virtualization Support

Cisco NX-OS supports multiple instances of the IS-IS protocol that runs on the same system. IS-IS supports Virtual Routing and Forwarding instances (VRFs). VRFs exist within virtual device contexts (VDCs). You can configure up to four IS-IS instances in a VDC.

By default, Cisco NX-OS places you in the default VDC and default VRF unless you specifically configure another VDC and VRF. See the *Cisco Nexus 7000 Series NX-OS Virtual Device Context Configuration Guide, Release 4.0* and Chapter 14, "Configuring Layer 3 Virtualization."

## High Availability and Graceful Restart

If a Cisco NX-OS system experiences a cold reboot, the network does not forward traffic to the system and removes the system from the network topology. In this scenario, IS-IS experiences a stateless restart, and Cisco NX-OS removes all neighbors. Cisco NX-OS applies the startup configuration, and IS-IS rediscovers the neighbors and shares the full IS-IS routing information again.

Cisco NX-OS supports high-availability. If a Cisco NX-OS system experiences a cold reboot, the network stops forwarding traffic to the system and removes the system from the network topology. In this scenario, IS-IS experiences a stateless restart, and removes all neighbors on the local system. Cisco NX-OS applies the startup configuration and IS-IS rediscovers the neighbors and shares the full IS-IS routing information again.

A platform with two supervisors that run Cisco NX-OS can experience a stateful supervisor switchover. Before the switchover happens, IS-IS initiates a graceful restart by announcing that IS-IS will be unavailable for some time. During a switchover, the network continues to forward traffic and keeps the system in the network topology.

After a switchover, Cisco NX-OS applies the running configuration, and IS-IS informs the neighbors that it is operational again.

IS-IS automatically restarts if the process experiences problems. After the restart, IS-IS initiates a graceful restart so that the platform is not taken out of the network topology. If you manually restart IS-IS, it performs a graceful restart, which is similar to a stateful switchover. The running configuration is applied in both cases.

**Note** You must enable graceful restart to support in-service software upgrades (ISSU) for IS-IS. If you disable graceful restart, Cisco NX-OS issues a warning that ISSU cannot be supported with this configuration.

## Multiple IS-IS Instances

Cisco NX-OS supports a maximum of four instances of the IS-IS protocol that run on the same node. You cannot configure multiple instances over the same interface. Every instance uses the same system router ID.

# Licensing Requirements for IS-IS

The following table shows the licensing requirements for this feature:

| Product | License Requirement |
|---|---|
| NX-OS | IS-IS requires an Enterprise Services license. For a complete explanation of the NX-OS licensing scheme and how to obtain and apply licenses, see the *Cisco Nexus 7000 Series NX-OS Licensing Guide, Release 4.0.* |

# Prerequisites for IS-IS

IS-IS has the following prerequisites:

- You must enable the IS-IS feature (see the "Enabling the IS-IS Feature" section on page 8-8).
- If you configure VDCs, install the Advanced Services license and enter the desired VDC (see the *Cisco Nexus 7000 Series NX-OS Virtual Device Context Configuration Guide, Release 4.0).*

# Configuration Guidelines and Limitations

IS-IS has the following configuration guidelines and limitations:

- You can configure a maximum of four IS-IS instances per VDC.

# Configuring IS-IS

To configure IS-IS, follow these steps:

**Step 1** Enable the IS-IS feature (see the "Enabling the IS-IS Feature" section on page 8-8).

**Step 2** Create an IS-IS instance (see the "Creating an IS-IS Instance" section on page 8-9).

**Step 3** Add an interface to the IS-IS instance (see the "Configuring IS-IS on an Interface" section on page 8-11).

**Step 4** Configure optional features, such as authentication, mesh groups, and dynamic host exchange.

This section contains the following topics:



**Note** If you are familiar with the Cisco IOS CLI, be aware that the Cisco NX-OS commands for this feature might differ from the Cisco IOS commands that you would use.

# IS-IS Configuration Modes

The following sections show how to enter each of the configuration modes. From a mode, you can enter the **?** command to display the commands available in that mode.

This section includes the following topics:



## Router Configuration Mode

The following example shows how to enter router configuration mode:

```
switch#: config t
switch(config)# router isis isp
switch(config-router)#
```

### Router Address Family Configuration Mode

The following example shows how to enter router address family configuration mode:

```
switch(config)# router isis isp
switch(config-router)# address-family ipv6 unicast
switch(config-router-af)#
```

# Enabling the IS-IS Feature

You must enable the IS-IS feature before you can configure IS-IS.

### BEFORE YOU BEGIN

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

### SUMMARY STEPS

1. **config t**
2. **feature isis**
3. **copy running-config startup-config**

### DETAILED STEPS

| | Command | Purpose |
|---|---|---|
| Step 1 | **config t**<br><br>**Example:**<br>switch# config t<br>switch(config)# | Enters configuration mode. |
| Step 2 | **feature isis**<br><br>**Example:**<br>switch(config)# feature isis | Enables the IS-IS feature. |
| Step 3 | **copy running-config startup-config**<br><br>**Example:**<br>switch(config)# copy running-config startup-config | (Optional) Saves this configuration change. |

Use the **no feature isis** command to disable the IS-IS feature and remove all associated configuration.

| Command | Purpose |
|---|---|
| **no feature isis**<br><br>**Example:**<br>switch(config)# no feature isis | Disables the IS-IS feature and removes all associated configuration. |

# Creating an IS-IS Instance

You can create an IS-IS instance and configure the area level for that instance.

## BEFORE YOU BEGIN

Ensure that you have enabled the IS-IS feature (see the "Enabling the IS-IS Feature" section on page 8-8).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

## SUMMARY STEPS

1. **config t**
2. **router is-is** *instance-tag*
3. **net** *network-entity-title*
4. **is-type** {**level-1** | **level-2** | **level-1-2**}
5. **show isis** [**vrf** *vrf-name*] **process**
6. **copy running-config startup-config**

## DETAILED STEPS

| | Command | Purpose |
|---|---|---|
| **Step 1** | **config t**<br><br>**Example:**<br>`switch# config t`<br>`switch(config)#` | Enters configuration mode. |
| **Step 2** | **router isis** *instance-tag*<br><br>**Example:**<br>`switch(config)# router isis Enterprise`<br>`switch(config-router)#` | Creates a new IS-IS instance with the configured *instance tag*. |
| **Step 3** | **net** *network-entity-title*<br><br>**Example:**<br>`switch(config-router)# net 47.0004.004d.0001.0001.0c11.1111.00` | Configures the NET for this IS-IS instance. |
| **Step 4** | **is-type** {**level-1** \| **level-2** \| **level-1-2**}<br><br>**Example:**<br>`switch(config-router)# is-type level-2` | (Optional) Configures the area level for this IS-IS instance. The default is level-1-2. |
| **Step 5** | **show isis** [**vrf** *vrf-name*] **process**<br><br>**Example:**<br>`switch(config)# show isis process` | (Optional) Displays a summary of IS-IS information for all IS-IS instances. |
| **Step 6** | **copy running-config startup-config**<br><br>**Example:**<br>`switch(config)# copy running-config startup-config` | (Optional) Saves this configuration change. |

Use the **no router isis** command to remove the IS-IS instance and the associated configuration.

| Command | Purpose |
|---|---|
| `no router isis` *instance-tag*<br><br>**Example:**<br>`switch(config)# no router isis Enterprise` | Deletes the IS-IS instance and all associated configuration. |

**Note** You must also remove any IS-IS commands configured in interface mode to completely remove all configuration for the IS-IS instance.

You can configure the following optional parameters for IS-IS:

| Command | Purpose |
|---|---|
| **distance** *value*<br><br>**Example:**<br>`switch(config-router)# distance 30` | Sets the administrative distance for IS-IS. The range is from 1 to 255. The default is 115. See the "Administrative Distance" section on page 1-6. |
| **log-adjacency-changes**<br><br>**Example:**<br>`switch(config-router)# log-adjacency-changes` | Sends a system message whenever an IS-IS neighbor changes state. |
| **lsp-mtu** *size*<br>**Example:**<br>`switch(config-router)# lsp-mtu 600` | Sets the MTU for LSPs in this IS-IS instance. The range is from 128 to 4352 bytes. The default is 1492. |
| **maximum-paths** *number*<br>**Example:**<br>`switch(config-router)# maximum-paths 6` | Configures the maximum number of equal-cost paths that IS-IS maintains in the route table. The range is from 1 to 16. The default is 4. |
| **reference-bandwidth** *bandwidth-value* {**Mbps** \| **Gbps**}<br><br>**Example:**<br>`switch(config-router)# reference-bandwidth 100 Gbps` | Sets the default reference bandwidth used for calculating the IS-IS cost metric. The range is from 1 to 4000 Gbps. The default is 40 Gbps. |

The following example shows how to create an IS-IS instance in a level 2 area:

```
switch# config t
switch(config)# router isis Enterprise
switch(config-router)# net 47.0004.004d.0001.0001.0c11.1111.00
switch(config-router)# is-type level 2
switch(config-router)# copy running-config startup-config
```

To clear neighbor statistics and remove adjacencies, use the following command in router configuration mode:

| Command | Purpose |
|---|---|
| **clear isis** [*instance-tag*] **adjacency** [***** \| *system-id* \| *interface*]<br>**Example:**<br>`switch(config-if)# clear isis adjacency *` | Clears neighbor statistics and removed adjacencies for this IS-IS instance. |

# Restarting an IS-IS Instance

You can restart an IS-IS instance. This clears all neighbors for the instance.

To restart an IS-IS instance and remove all associated neighbors, use the following command:

| Command | Purpose |
|---|---|
| **restart isis** instance-tag<br><br>**Example:**<br>`switch(config)# restart isis Enterprise` | Restarts the IS-IS instance and removes all neighbors. |

# Configuring IS-IS on an Interface

You can add an interface to an IS-IS instance.

## BEFORE YOU BEGIN

Ensure that you have enabled the IS-IS feature (see the "Enabling the IS-IS Feature" section on page 8-8).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

## SUMMARY STEPS

1. **config t**
2. **interface** *interface-type slot/port*
3. **ip router isis** *instance-tag*

   or

   **ipv6 router isis** *instance-tag*
4. **show isis** [**vrf** *vrf-name*] [*instance-tag*] **interface** [*interface-type slot/port*]
5. **copy running-config startup-config**

## DETAILED STEPS

| | Command | Purpose |
|---|---|---|
| Step 1 | **config t**<br><br>**Example:**<br>`switch# config t`<br>`switch(config)#` | Enters configuration mode. |
| Step 2 | **interface** *interface-type slot/port*<br><br>**Example:**<br>`switch(config)# interface ethernet 1/2`<br>`switch(config-if)#` | Enters interface configuration mode. |
| Step 3 | **ip router isis** *instance-tag*<br><br>**Example:**<br>`switch(config-if)# ip router isis Enterprise` | Associates this IPv4 interface with an IS-IS instance. |
| | **ipv6 router isis** *instance-tag*<br><br>**Example:**<br>`switch(config-if)# ipv6 router isis Enterprise` | Associates this IPv6 interface with an IS-IS instance. |
| Step 4 | **show isis** [**vrf** *vrf-name*] [*instance-tag*] **interface** [*interface-type slot/port*]<br><br>**Example:**<br>`switch(config)# show isis Enterprise ethernet 1/2` | (Optional) Displays IS-IS information for an interface. |
| Step 5 | **copy running-config startup-config**<br><br>**Example:**<br>`switch(config)# copy running-config startup-config` | (Optional) Saves this configuration change. |

You can configure the following optional parameters for IS-IS in interface mode:

| Command | Purpose |
|---|---|
| **isis circuit-type** {**level-1** \| **level-2** \| **level-1-2**}<br><br>**Example:**<br>`switch(config-if)# isis circuit-type level-2` | Sets the type of adjacency that this interface participates in. Use this command only for routers that participate in both Level 1 and Level 2 areas. |
| **isis metric** *value* {**level-1** \| **level-2**}<br><br>**Example:**<br>`switch(config-if)# isis metric 30` | Sets the IS-IS metric for this interface. The range is from 1 to 16777214. The default is 10. |
| **isis passive** {**level-1** \| **level-2** \| **level-1-2**}<br><br>**Example:**<br>`switch(config-if)# isis passive level-2` | Prevents the interface from forming adjacencies but still advertises the prefix associated with the interface. |

The following example shows how to add Ethernet 1/2 interface to an IS-IS instance:

```
switch# config t
switch(config)# interface ethernet 1/2
switch(config-if)# ip router isis Enterprise
switch(config-if)# copy running-config startup-config
```

# Configuring IS-IS Authentication in an Area

You can configure IS-IS to authenticate LSPs in an area.

## BEFORE YOU BEGIN

Ensure that you have enabled the IS-IS feature (see the "Enabling the IS-IS Feature" section on page 8-8).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

## SUMMARY STEPS

1. **config t**
2. **router isis** *instance-tag*
3. **authentication-type** {**cleartext** | **md5**} {**level-1** | **level-2**}
4. **authentication-key keychain** *key* {**level-1** | **level-2**}
5. **authentication-check** {**level-1** | **level-2**}
6. **copy running-config startup-config**

## DETAILED STEPS

| | Command | Purpose |
|---|---|---|
| **Step 1** | **config t**<br><br>**Example:**<br>switch# config t<br>switch(config)# | Enters configuration mode. |
| **Step 2** | **router isis** *instance-tag*<br><br>**Example:**<br>switch(config)# router isis Enterprise<br>switch(config-router)# | Creates a new IS-IS instance with the configured *instance tag*. |
| **Step 3** | **authentication-type** {**cleartext** \| **md5**} {**level-1** \| **level-2**}<br><br>**Example**:<br>switch(config-router)# authentication-type cleartext level-2 | Sets the authentication method used for a Level 1 or Level 2 area as cleartext or as an MD5 authentication digest. |

| | Command | Purpose |
|---|---|---|
| Step 4 | **authentication-key keychain** *key* {**level-1** \| **level-2**}<br><br>**Example:**<br>`switch(config-router)# authentication-key ISISKey level-2` | Configures the authentication key used for an IS-IS area-level authentication. |
| Step 5 | **authentication-check** {**level-1** \| **level-2**}<br><br>**Example:**<br>`switch(config-router)# authentication-check level-2` | (Optional) Enables checking the authentication parameters in a received packet. |
| Step 6 | **copy running-config startup-config**<br><br>**Example:**<br>`switch(config-router)# copy running-config startup-config` | (Optional) Saves this configuration change. |

The following example shows how to configure cleartext authentication on an IS-IS instance:

```
switch# config t
switch(config)# router isis Enterprise
switch(config-router)# authentication-type cleartext level-2
switch(config-router)# authentication-key keychain ISISKey level-2
switch(config-router)# copy running-config startup-config
```

# Configuring IS-IS Authentication on an Interface

You can configure IS-IS to authenticate Hello packets on an interface.

## BEFORE YOU BEGIN

Ensure that you have enabled the IS-IS feature (see the "Enabling the IS-IS Feature" section on page 8-8).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

## SUMMARY STEPS

1. **config t**
2. **interface** *interface-type slot/port*
3. **isis authentication-type** {**cleartext** | **md5**} [**level-1** | **level-2**]
4. **isis authentication-key keychain** *key* [**level-1** | **level-2**]
5. **isis authentication-check** [**level-1** | **level-2**]
6. **copy running-config startup-config**

## DETAILED STEPS

| | Command | Purpose |
|---|---|---|
| **Step 1** | **config t**<br><br>**Example:**<br>`switch# config t`<br>`switch(config)#` | Enters configuration mode. |
| **Step 2** | **interface** *interface-type slot/port*<br><br>**Example:**<br>`switch(config)# interface ethernet 1/2`<br>`switch(config-if)#` | Enters interface configuration mode. |
| **Step 3** | **isis authentication-type** {**cleartext** \| **md5**} [**level-1** \| **level-2**]<br><br>**Example**:<br>`switch(config-if)# isis authentication-type cleartext level-2` | Sets the authentication type for IS-IS on this interface as cleartext or as an MD5 authentication digest. |
| **Step 4** | **isis authentication-key keychain** *key* [**level-1** \| **level-2**]<br><br>**Example**:<br>`switch(config-if)# isis authentication-key ISISKey level-2` | Configures the authentication key used for IS-IS on this interface. |
| **Step 5** | **isis authentication-check** {**level-1** \| **level-2**}<br><br>**Example**:<br>`switch(config-if)# isis authentication-check` | Optional) Enables checking the authentication parameters in a received packet. |
| **Step 6** | **copy running-config startup-config**<br><br>**Example:**<br>`switch(config-if)# copy running-config startup-config` | (Optional) Saves this configuration change. |

The following example shows how to configure cleartext authentication on an IS-IS instance:

```
switch# config t
switch(config)# interface ethernet 1/2
switch(config-if)# isis authentication-type cleartext level-2
switch(config-if)# isis authentication-key keychain ISISKey
switch(config-if)# copy running-config startup-config
```

# Configuring a Mesh Group

You can add an interface to a mesh group to limit the amount of LSP flooding for interfaces in that mesh group. You can optionally block all LSP flooding on an interface in a mesh group.

To add an interface to a mesh group, use the following command in interface configuration mode:

| Command | Purpose |
|---|---|
| **isis mesh-group** {**blocked** \| *mesh-id*}<br><br>**Example**:<br>`switch(config-if)# isis mesh-group 1` | Adds this interface to a mesh group. The range is from 1 to 4294967295. |

# Configuring a Designated Intermediate System

You can configure a router to become the designated intermediate system (DIS) for a multiaccess network by setting the interface priority.

To configure the DIS, use the following command in interface configuration mode:

| Command | Purpose |
|---|---|
| **isis priority** *number*<br><br>**Example**:<br>`switch(config-if)# isis priority 100` | Sets the priority for DIS selection. Range is from 0 to 127. The default is 64. |

# Configuring Dynamic Host Exchange

You can configure IS-IS to map between the system ID and the hostname for a router using dynamic host exchange.

To configure dynamic host exchange, use the following command in router configuration mode:

| Command | Purpose |
|---|---|
| **hostname dynamic**<br><br>**Example**:<br>`switch(config-router)# hostname dynamic` | Enables dynamic host exchange. |

# Setting the Overload Bit

You can configure the router to signal other routers not to use this router as an intermediate hop in their shortest path first (SPF) calculations. You can optionally configure the overload bit temporarily on startup, until BGP converges.

In addition to setting the overload bit, you might also want to suppress certain types of IP prefix advertisements from LSPs for Level 1 or Level 2 traffic.

To set the overload bit, use the following command in router configuration mode:

| Command | Purpose |
|---|---|
| **set-overload-bit** {**always** \| **on-startup** {*seconds* \| **wait-for bgp** *as-number*}} [**suppress** [**interlevel** \| **external**]]<br><br>**Example**:<br>`switch(config-router)# set-overload-bit on-startup 30` | Sets the overload bit for IS-IS. The *seconds* range is from 5 to 86400. |

# Configuring a Summary Address

You can create aggregate addresses that are represented in the routing table by a summary address. One summary address can include multiple groups of addresses for a given level. Cisco NX-OS advertises the smallest metric of all the more-specific routes.

## BEFORE YOU BEGIN

Ensure that you have enabled the IS-IS feature (see the "Enabling the IS-IS Feature" section on page 8-8).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

## SUMMARY STEPS

1. **config t**
2. **router isis** *instance-tag*
3. **address-family** {**ipv4** | **ipv6**} {**unicast** | **multicast**}
4. **summary-address** {*ip-prefix/mask-len* | *ipv6-prefix/mask-len*} {**level-1** | **level-2** | **level-1-2**}
5. **show isis** [**vrf** *vrf-name*] **ip summary-address** *ip-prefix* [**longer-prefixes**]
6. **show isis** [**vrf** *vrf-name*] **ipv6 summary-address** *ipv6-prefix* [**longer-prefixes**]
7. **copy running-config startup-config**

## DETAILED STEPS

| | Command | Purpose |
|---|---|---|
| **Step 1** | **config t**<br><br>**Example:**<br>`switch# config t`<br>`switch(config)#` | Enters configuration mode. |
| **Step 2** | **router isis** *instance-tag*<br><br>**Example:**<br>`switch(config)# router isis Enterprise`<br>`switch(config-router)#` | Creates a new IS-IS instance with the configured *instance tag*. |

| | Command | Purpose |
|---|---|---|
| Step 3 | **address-family** {**ipv4** \| **ipv6**} {**unicast** \| **multicast**}<br><br>**Example**:<br>switch(config-router)# address-family ipv4 unicast<br>switch(config-router-af)# | Enters address family configuration mode. |
| Step 4 | **summary-address** {*ip-prefix/mask-len* \| *ipv6-prefix/mask-len*} {**level-1** \| **level-2** \| **level-1-2**}<br><br>**Example**:<br>switch(config-router-af)# summary-address 192.0.2.0/24 level-2 | Configures a summary address for an ISIS area for IPv4 or IPv6 addresses. |
| Step 5 | **show isis** [**vrf** *vrf-name*] **ip summary-address** *ip-prefix* [**longer-prefixes**]]<br><br>**Example**:<br>switch(config-if)# show isis ip summary-address | (Optional) Displays IS-IS IPv4 summary address information. |
| Step 6 | **show isis** [**vrf** *vrf-name*] **ipv6 summary-address** *ipv6-prefix* [**longer-prefixes**]]<br><br>**Example**:<br>switch(config-if)# show isis ipv6 summary-address | (Optional) Displays IS-IS IPv6 summary address information. |
| Step 7 | **copy running-config startup-config**<br><br>**Example:**<br>switch(config--if)# copy running-config startup-config | (Optional) Saves this configuration change. |

The following example shows how to configure an IPv4 unicast summary address for IS-IS:

```
switch# config t
switch(config)# router isis Enterprise
switch(config-router)# address-family ipv4 unicast
switch(config-router-af)# summary-address 192.0.2.0/24 level-2
switch(config-router-af)# copy running-config startup-config
```

# Configuring Redistribution

You can configure IS-IS to accept routing information from another routing protocol and redistribute that information through the IS-IS network. You can optionally assign a default route for redistributed routes.

## BEFORE YOU BEGIN

Ensure that you have enabled the IS-IS feature (see the "Enabling the IS-IS Feature" section on page 8-8).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

## SUMMARY STEPS

1. **config t**
2. **router isis** *instance-tag*
3. **address-family** {**ipv4** | **ipv6**} {**unicast** | **multicast**}
4. **redistribute** {**bgp** *as* | **direct** | **eigrp** *as* | **isis** *id* | **ospf** *id* | **ospfv3** *id* | **rip** *id* | **static**} **route-map** *map-name*
5. **default-information originate** [**always**] [**route-map** *map-name*]
6. **distribute** {**level-1** | **level-2**} **into** {**level-1** | **level-2**} {**route-map** *route-map* | **all**}
7. **show isis** [**vrf** *vrf-name*] {**ip** | **ipv6**} **route** {*ip-prefix* | *ip6-prefix*} [*detail* | **longer-prefixes** [**summary** | **detail**]]
8. **copy running-config startup-config**

## DETAILED STEPS

| | Command | Purpose |
|---|---|---|
| **Step 1** | **config t**<br><br>**Example:**<br>`switch# config t`<br>`switch(config)#` | Enters configuration mode. |
| **Step 2** | **router isis** *instance-tag*<br><br>**Example:**<br>`switch(config)# router isis Enterprise`<br>`switch(config-router)#` | Creates a new IS-IS instance with the configured *instance tag*. |
| **Step 3** | **address-family** {**ipv4** \| **ipv6**} {**unicast** \| **multicast**}<br><br>**Example**:<br>`switch(config-router)# address-family ipv4 unicast`<br>`switch(config-router-af)#` | Enters address family configuration mode. |
| **Step 4** | **redistribute** {**bgp** *as* \| **direct** \| **eigrp** *as* \| **isis** *id* \| **ospf** *id* \| **ospfv3** *id* \| **rip** *id* \| **static** \| **direct**} **route-map** *map-name*<br><br>**Example**:<br>`switch(config-router-af)# redistribute eigrp 201 route-map ISISmap` | Redistributes routes from other protocols into IS-IS. See the "Configuring Route Maps" section on page 15-9 for more information about route maps. |
| **Step 5** | **default-information originate** [**always**] [**route-map** *map-name*]<br><br>**Example**:<br>`switch(config-router-af)# default-information originate always` | (Optional) Generates a default route into IS-IS. |
| **Step 6** | **distribute** {**level-1** \| **level-2**} **into** {**level-1** \| **level-2**} {**route-map** *route-map* \| **all**}<br><br>**Example**:<br>`switch(config-router-af)# distribute level-1 into level-2 all` | (Optional) Redistributes routes from one IS-IS level to the other IS-IS level. |

| | Command | Purpose |
|---|---|---|
| Step 7 | **show isis** [**vrf** *vrf-name*] {**ip** \| **ipv6**} **route** {*ip-prefix ip6-prefix*} [*detail* \| **longer-prefixes** [**summary** \| **detail**]]<br><br>**Example:**<br>`switch(config-router-af)# show isis ip route` | (Optional) Shows the routes IS-IS. |
| Step 8 | **copy running-config startup-config**<br><br>**Example:**<br>`switch(config-router-af)# copy running-config startup-config` | (Optional) Saves this configuration change. |

The following example shows how to redistribute EIGRP into IS-IS:

```
switch# config t
switch(config)# router isis Enterprise
switch(config-router)# address-family ipv4 unicast
switch(config-router-af)# redistribute eigrp 201 route-map ISISmap
switch(config-router-af)# copy running-config startup-config
```

# Configuring a Graceful Restart

You can configure a graceful restart for IS-IS.

## BEFORE YOU BEGIN

Ensure that you have enabled the IS-IS feature (see the "Enabling the IS-IS Feature" section on page 8-8).

Create the VDCs and VRFs.

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

## SUMMARY STEPS

1. **config t**
2. **router isis** *instance-tag*
3. **graceful-restart**
4. **graceful-restart t3 manual** *time*
5. **show running-config isis**
6. **copy running-config startup-config**

### DETAILED STEPS

| | Command | Purpose |
|---|---|---|
| **Step 1** | **config t**<br><br>**Example:**<br>`switch# config t`<br>`switch(config)#` | Enters configuration mode. |
| **Step 2** | **router isis** *instance-tag*<br><br>**Example:**<br>`switch(config)# router isis Enterprise`<br>`switch(config-router)#` | Creates a new IS-IS process with the configured name. |
| **Step 3** | **graceful-restart**<br><br>**Example:**<br>`switch(config-router)# graceful-restart` | Enables a graceful restart and the graceful restart helper functionality. Enabled by default. |
| **Step 4** | **graceful-restart t3 manual** *time*<br><br>**Example:**<br>`switch(config-router)# graceful-restart t3 manual 300` | Configures the graceful restart T3 timer. The range is from 30 to 65535 seconds. The default is 60. |
| **Step 5** | **show running-config isis**<br><br>**Example:**<br>`switch(config-router)# show running-config isis` | (Optional) Displays the IS-IS configuration. |
| **Step 6** | **copy running-config startup-config**<br><br>**Example:**<br>`switch(config-router)# copy running-config startup-config` | (Optional) Saves this configuration change. |

The following example shows how to enable a graceful restart:

```
switch# config t
switch(config)# router isis Enterprise
switch(config-router)# graceful-restart
switch(config-router)# copy running-config startup-config
```

# Configuring Virtualization

You can configure multiple IS-IS instances in each VDC. You can also create multiple VRFs within each VDC and use the same or multiple IS-IS instances in each VRF. You assign an IS-IS interface to a VRF.

You must configure a NET for the configured VRF.

**Note** Configure all other parameters for an interface after you configure the VRF for an interface. Configuring a VRF for an interface deletes all the configuration for that interface.

### BEFORE YOU BEGIN

Ensure that you have enabled the IS-IS feature (see the "Enabling the IS-IS Feature" section on page 8-8).

Create the VDCs.

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

### SUMMARY STEPS

1. **config t**
2. **vrf context** *vrf_name*
3. **exit**
4. **router isis** *instance-tag*
5. **vrf** *vrf_name*
6. **net** *network-entity-title*
7. configure optional parameters
8. **interface** *type slot/port*
9. **vrf member** *vrf-name*
10. **ip address** *ip-prefix/length*
11. **ip router isis** *instance-tag*

    or

    **ipv6 router isis** *instance-tag*
12. **show isis** [**vrf** *vrf-name*] [*instance-tag*] **interface** [*interface-type slot/port*]
13. **copy running-config startup-config**

### DETAILED STEPS

| | Command | Purpose |
|---|---|---|
| **Step 1** | **config t**<br><br>**Example:**<br>switch# config t<br>switch(config)# | Enters configuration mode. |
| **Step 2** | **vrf context** *vrf-name*<br><br>**Example:**<br>switch(config)# vrf context RemoteOfficeVRF<br>switch(config-vrf)# | Creates a new VRF and enters VRF configuration mode. |
| **Step 3** | **router isis** *instance-tag*<br><br>**Example:**<br>switch(config)# router isis Enterprise<br>switch(config-router)# | Creates a new IS-IS instance with the configured instance tag. |

| | Command | Purpose |
|---|---|---|
| Step 4 | **vrf** *vrf-name*<br><br>**Example:**<br>`switch(config-router)# vrf RemoteOfficeVRF`<br>`switch(config-router-vrf)#` | (Optional) Enters VRF configuration mode. |
| Step 5 | **net** *network-entity-title*<br><br>**Example:**<br>`switch(config-router-vrf)# net 47.0004.004d.0001.0001.0c11.1111.00` | Configures the NET for this IS-IS instance. |
| Step 6 | **exit**<br><br>**Example:**<br>`switch(config-router)# exit`<br>`switch(config-router)#` | Exits router VRF configuration mode. |
| Step 7 | **address-family** {**ipv4** \| **ipv6**} {**unicast** \| **multicast**}<br><br>**Example**:<br>`switch(config-router)# address-family ipv4 unicast`<br>`switch(config-router-af)#` | (Optional) Enters address family configuration mode. |
| Step 8 | **redistribute** {**bgp** *as* \| **direct** \| **eigrp** *as* \| **isis** *id* \| **ospf** *id* \| **ospfv3** *id* \| **rip** *id* \| **static** \| **direct**} **route-map** *map-name*<br><br>**Example**:<br>`switch(config-router-af)# redistribute eigrp 201 route-map ISISmap` | (Optional) Redistributes routes from other protocols into IS-IS. See the "Configuring Route Maps" section on page 15-9 for more information about route maps. |
| Step 9 | **interface ethernet** *slot/port*<br><br>**Example**:<br>`switch(config)# interface ethernet 1/2`<br>`switch(config-if)#` | Enters interface configuration mode. |
| Step 10 | **vrf member** *vrf-name*<br><br>**Example:**<br>`switch(config-if)# vrf member RemoteOfficeVRF` | Adds this interface to a VRF. |
| Step 11 | **ip address** *ip-prefix/length*<br><br>**Example:**<br>`switch(config-if)# ip address 209.0.2.1/16` | Configures an IP address for this interface. You must do this step after you assign this interface to a VRF. |
| Step 12 | **ip router isis** *instance-tag*<br><br>**Example**:<br>`switch(config-if)# ip router isis Enterprise` | Associates this IPv4 interface with an IS-IS instance. |
| | **ipv6 router isis** *instance-tag*<br><br>**Example**:<br>`switch(config-if)# ipv6 router isis Enterprise` | Associates this IPv6 interface with an IS-IS instance. |

| | Command | Purpose |
|---|---|---|
| Step 13 | **show isis** [**vrf** *vrf-name*] [*instance-tag*] **interface** [*interface-type slot/port*]<br><br>**Example:**<br>`switch(config-if)# show isis Enterprise ethernet 1/2` | (Optional) Displays IS-IS information for an interface. in a VRF. |
| Step 14 | **copy running-config startup-config**<br><br>**Example:**<br>`switch(config-if)# copy running-config startup-config` | (Optional) Saves this configuration change. |

The following example shows how to create a VRF and add an interface to the VRF:

```
switch# config t
switch(config)# vrf context NewVRF
switch(config-vrf)# exit
switch(config)# router isis Enterprise
switch(config-router)# vrf NewVRF
switch(config-router-vrf)# net 47.0004.004d.0001.0001.0c11.1111.00
switch(config-router-vrf)# interface ethernet 1/2
switch(config-if)# vrf membmer NewVRF
switch(config-if)# ip address 209.0.2.1/16
switch(config-if)# ip router isis Enterprise
switch(config-if)# copy running-config startup-config
```

# Tuning IS-IS

You can tune IS-IS to match your network requirements.

You can use the following optional commands in router configuration mode to tune IS-IS:

| Command | Purpose |
|---|---|
| **lsp-gen-interval** [**level-1** \| **level-2**] *lsp-max-wait* [*lsp-initial-wait lsp-second-wait*]<br><br>**Example:**<br>`switch(config-router)# lsp-gen-interval level-1 500 500 500` | Configures the IS-IS throttle for LSP generation. The optional parameters are as follows:<br>• lsp-max-wait—The maximum wait between the trigger and LSP generation. The range is from 500 to 65535 milliseconds.<br>• lsp-initial-wait—The initial wait between the trigger and LSP generation. The range is from 50 to 65535 milliseconds.<br>• lsp-second-wait—The second wait used for LSP throttle during backoff. The range is from 50 to 65535 milliseconds. |
| **max-lsp-lifetime** *lifetime*<br><br>**Example:**<br>`switch(config-router)# max-lsp-lifetime 500` | Sets the maximum LSP lifetime in seconds. The range is from 1 to 65535. The default is 1200. |

| Command | Purpose |
|---|---|
| **spf-interval** [**level-1** \| **level-2**] *spf-max-wait* [*spf-initial-wait* *spf-second-wait*]<br><br>**Example**:<br>`switch(config-router)# spf-interval level-2 500 500 500` | Configures the interval between LSA arrivals. The optional parameters are as follows:<br>• lsp-max-wait—The maximum wait between the trigger and SPF computation. The range is from 500 to 65535 milliseconds.<br>• lsp-initial-wait—The initial wait between the trigger and SPF computation. The range is from 50 to 65535 milliseconds.<br>• lsp-second-wait—The second wait used for SPF computation during backoff. The range is from 50 to 65535 milliseconds. |
| **shutdown**<br><br>**Example**:<br>`switch(config-router)# shutdown` | Shuts down this IS-IS instance without removing the configuration. |
| **wide-metric-only**<br><br>**Example**:<br>`switch(config-router)# wide-metric-only` | Configures the IS-IS instance to advertise a wide metric. |

You can use the following optional command in router address configuration mode:

| Command | Purpose |
|---|---|
| **adjacency-check**<br>**Example**:<br>`switch(config-router-af)# adjacency-check` | Performs and adjacency check to verify that an IS-IS instance forms an adjacency only with a remote IS-IS entity that supports the same address family. Enabled by default. |

You can use the following optional commands in interface configuration mode to tune IS-IS:

| Command | Purpose |
|---|---|
| **isis hello-interval** *seconds* [**level-1** \| **level-2**]<br><br>**Example**:<br>`switch(config-if)# isis hello-interval 20` | Sets the hello interval in seconds for IS-IS. The range is from 1 to 65535. The default is 10. |
| **isis hello-multiplier** *num* [**level-1** \| **level-2**]<br><br>**Example**:<br>`switch(config-if)# isis hello-multiplier 20` | Specifies the number of IS-IS hello packets that a neighbor must miss before the router tears down an adjacency. The range is from 3 to 1000. The default is 3. |

| Command | Purpose |
|---|---|
| **isis hello-padding**<br><br>**Example:**<br>`switch(config-if)# isis hello-padding` | Pads the Hello packet to the full MTU. The default is enabled. |
| **isis lsp-interval** *milliseconds*<br><br>**Example:**<br>`switch(config-if)# isis lsp-interval 20` | Sets the interval in milliseconds between LSPs sent on this interface during flooding. The range is from 10 to 65535. The default is 33. |

# Verifying IS-IS Configuration

To verify the IS-IS configuration, use the following commands:

| Command | Purpose |
|---|---|
| **show isis** [**vrf** *vrf-name*] **adjacency** [*interface*] [**detail** \| **summary**] | Displays the IS-IS adjacencies. Use the **clear isis adjacency** command to clear these statistics. |
| **show isis** [**vrf** *vrf-name*] **database** [**level-1** \| **level-2**] [**detail** \| **summary**] [*LSP ID*] {[**ip prefix** *ip-prefix*] \| [**ipv6 prefix** *ipv6-prefix*] \| [**router-id** *router-id*] \| [**adjacency** *node-id*]} | Displays the IS-IS LSP database. |
| **show isis** [**vrf** *vrf-name*] *hostname* | Displays the dynamic host exchange information. |
| **show isis** [**vrf** *vrf-name*] [*instance-tag*] **interface** [*interface*] | Displays the IS-IS interface information. |
| **show isis** [**vrf** *vrf-name*] **mesh-group** | Displays the mesh group information. |
| **show isis** [**vrf** *vrf-name*] **process** | Displays the IS-IS information. |
| show isis [**vrf** *vrf-name*] [**ipv6**] **route** [*ip-prefix* \| *ipv6-prefix] [detail* \| **longer-prefixes** [**summary** \| **detail**]] | Displays the IS-IS route table. |
| **show isis** [**vrf** *vrf-name*] **spf-log** [**detail**] | Displays the IS-IS SPF calculation statistics. |
| **show isis** [**vrf** *vrf-name*] [**ipv6**] **summary-address** [*ip-prefix* \| *ipv6-prefix* [*longer-prefixes*]] | Displays IS-IS the summary address information. |
| **show running-configuration isis** | Displays the current running IS-IS configuration. |

For detailed information about the fields in the output from these commands, see the *Cisco NX-OS Command Reference*.

# Displaying IS-IS Statistics

To display IS-IS statistics, use the following commands:

| Command | Purpose |
|---|---|
| **show isis** [**vrf** *vrf-name*] [*instance-tag*] **adjacency** [*interface*] [**system-ID**] | Displays the IS-IS adjacency statistics. |
| **show isis** [**vrf** *vrf-name*] [*instance-tag*] **statistics** [*interface*] | Displays the IS-IS interface statistics. |
| **show isis** [**vrf** *vrf-name*] [**ip** \| **ipv4**] **route-map statistics redistribute** {**bgp** *id* \| **direct** \| **eigrp** *id* \| **isis** *id* \| **ospf** *id* \| **rip** *id* \| **static**} | Displays the IS-IS redistribution statistics |
| **show isis** [**vrf** *vrf-name*] **route-map statistics distribute** {**level-1** \| **level-2**} **into** {**level-1** \| **level-2**}} | Displays IS-IS distribution statistics for routes distributed between levels. |

To clear IS-IS configuration statistics, perform one of the following tasks:

| Command | Purpose |
|---|---|
| **clear isis** [**vrf** *vrf-name*] [*instance-tag*] **adjacency** [*interface*] [**system-ID**] | Clears the IS-IS adjacency statistics. |
| **clear isis** [**vrf** *vrf-name*] [*instance-tag*] **statistics** [*interface*] | Clears the IS-IS interface statistics. |
| **clear isis** [**vrf** *vrf-name*] [**ip** \| **ipv4**] **route-map statistics redistribute** {**bgp** *id* \| **direct** \| **eigrp** *id* \| **isis** *id* \| **ospf** *id* \| **rip** *id* \| **static**} | Clears the IS-IS redistribution statistics |
| **clear isis** [**vrf** *vrf-name*] **route-map statistics distribute** {**level-1** \| **level-2**} **into** {**level-1** \| **level-2**}} | Clears IS-IS distribution statistics for routes distributed between levels. |

# IS-IS Example Configuration

The following example shows how to configure IS-IS:

```
router isis Enterprise
 is-type level-1
 net 49.0001.0000.0000.0003.00
 graceful-restart
 address-family ipv4 unicast
  default-information originate

interface ethernet 2/1
 ip address 192.0.2.1/24
 isis circuit-type level-1
 ip router isis Enterprise
```

# Related Topics

See the Chapter 15, "Configuring Route Policy Manager" for more information on route maps.

# Default Settings

Table 8-1 lists the default settings for IS-IS parameters.

*Table 8-1 Default IS-IS Parameters*

| Parameters | Default |
|---|---|
| Administrative distance | 115 |
| Area level | level-1-2 |
| DIS priority | 64 |
| Graceful restart | enabled |
| Hello multiplier | 3 |
| Hello padding | enabled |
| Hello time | 10 seconds |
| IS-IS feature | disabled |
| LSP interval | 33 |
| LSP MTU | 1492 |
| Maximum LSP lifetime | 1200 seconds |
| Maximum paths | 4 |
| Metric | 10 |
| Reference bandwidth | 40 Gbps |

# Additional References

For additional information related to implementing IS-IS, see the following sections:

- Related Documents, page 8-29
- Standards, page 8-29

## Related Documents

| Related Topic | Document Title |
| --- | --- |
| IS-IS CLI commands | *Cisco Nexus 7000 Series NX-OS Unicast Routing Command Reference, Release 4.0* |
| VDCs and VRFs | *Cisco Nexus 7000 Series NX-OS Virtual Device Context Configuration Guide, Release 4.0* |

## Standards

| Standards | Title |
| --- | --- |
| No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature. | — |